

WHAT IS CLAIMED IS:

1. A printed circuit board assembly with optical devices packaged therein, comprising:

5 a plate type heat spreader;

a driving printed circuit board die bonded to a top of the heat spreader to convert electrical and optical signals to optical and electrical signals, respectively;

10 a driving integrated circuit die bonded to the top of the heat spreader and wire bonded to the driving printed circuit board;

an optical signal transmitting/receiving printed circuit board die bonded to a bottom of the heat spreader, with at least one waveguide for transmitting optical signals being
15 arranged therein;

at least one optical signal coupling block mounted on the optical signal transmitting/receiving printed circuit board; and

optical devices die bonded to the bottom of the heat
20 spreader and wire bonded to the optical signal transmitting/receiving printed circuit board to transfer optical signals to the optical signal coupling block.

2. The printed circuit board assembly according to claim
25 1, further comprising at least one complementary type heat

spreader arranged at an edge portion of the plate type heat spreader.

3. The printed circuit board assembly according to claim
5 1, wherein the plate type heat spreader is a metal core with high heat transmissibility.

4. The printed circuit board assembly according to claim
1, wherein the plate type heat spreader is used as a ground
10 terminal.

5. The printed circuit board assembly according to claim
1, wherein the driving integrated circuit is one of a multiplexer and a demultiplexer for modulating and
15 demodulating electrical signals and optical signals, respectively.

6. The printed circuit board assembly according to claim
1, wherein the optical devices are Vertical-Cavity Surface-
20 Emitting Lasers (VCSELs) or photo detectors.

7. The printed circuit board assembly according to claim
1, wherein the optical devices are arranged in an array form that allows multi-channel optical signals to be simultaneously
25 transmitted and received.

8. The printed circuit board assembly according to claim 7, wherein the optical devices are constructed such that a size of the optical signal coupling block is adjusted, and an array pitch between the optical devices for transferring optical signals to the optical signal coupling block is varied to correspond to the adjusted size of the optical signal coupling block.

9. The printed circuit board assembly according to claim 1, wherein the optical signal coupling block is a fiber or pipe block.

10. The printed circuit board assembly according to claim 1, wherein the optical devices are constructed such that an array pitch between the optical devices is adjusted to be less than or equal to 250 μm .

11. The printed circuit board assembly according to claim 1, further comprising at least one fixing guide attached to an edge portion of the plate type heat spreader to prevent alignment error when the printed circuit boards are attached to the plate type heat spreader.

12. The printed circuit board assembly according to claim

13, further comprising alignment targets attached to predetermined positions of the optical devices and the optical signal transmitting/receiving printed circuit board to accurately arrange the optical devices.

5

13. The printed circuit board assembly according to claim 1, wherein the plate type heat spreader includes a plurality of signal holes and ground holes formed therein.

10

14. The printed circuit board assembly according to claim 13, wherein the plurality of signal holes are formed by previously forming larger holes, filling the larger holes with dielectric materials for insulation, forming conductive holes through center portions of the dielectric materials, and
15 gilding the conductive holes, before the plate type heat spreader is attached to the printed circuit boards.

15. The printed circuit board assembly according to claim 13, wherein the plurality of ground holes are formed by
20 previously forming larger holes, filling the larger holes with conductive paste, forming conductive holes through center portions of the conductive paste, and gilding the conductive holes, before the plate type heat spreader is attached to the printed circuit boards.

25

16. A printed circuit board assembly with optical devices packaged therein, comprising:

a plate type heat spreader;

a driving printed circuit board die bonded to a top of
5 the heat spreader to convert electrical and optical signals to optical and electrical signals, respectively;

a driving integrated circuit arranged on the driving printed circuit board and flip-chip bonded to the driving printed circuit board;

10 an optical signal transmitting/receiving printed circuit board die bonded to a bottom of the heat spreader, with at least one waveguide for transferring optical signals being arranged therein;

at least one optical signal coupling block mounted on the
15 optical signal transmitting/receiving printed circuit board;
and

optical devices arranged on the optical signal transmitting/receiving printed circuit board and flip-chip bonded thereto to transfer optical signals to the optical
20 signal coupling block.

17. The printed circuit board assembly according to claim 16, further comprising at least one complementary type heat spreader arranged at an edge portion of the plate type heat
25 spreader.

18. The printed circuit board assembly according to claim 16, wherein the plate type heat spreader is a metal core with high heat transmissibility.

5

19. The printed circuit board assembly according to claim 16, wherein the plate type heat spreader is used as a ground terminal.

10

20. The printed circuit board assembly according to claim 16, wherein the driving integrated circuit is one of a multiplexer and a demultiplexer for modulating and demodulating electrical signals and optical signals, respectively.

15

21. The printed circuit board assembly according to claim 16, wherein the optical devices are Vertical-Cavity Surface-Emitting Lasers (VCSELs) or photo detectors.

20

22. The printed circuit board assembly according to claim 16, wherein the optical devices are arranged in an array form that allows multi-channel optical signals to be simultaneously transmitted and received.

25

23. The printed circuit board assembly according to claim

22, wherein the optical devices are constructed such that a size of the optical signal coupling block is adjusted, and an array pitch between the optical devices for transferring optical signals to the optical signal coupling block is varied
5 to correspond to the adjusted size of the optical signal coupling block.

24. The printed circuit board assembly according to claim 16, wherein the optical signal coupling block is a fiber or
10 pipe block.

25. The printed circuit board assembly according to claim 16, wherein the optical devices are constructed such that an array pitch between the optical devices is adjusted to be less
15 than or equal to 250 μm .

26. The printed circuit board assembly according to claim 16, further comprising at least one fixing guide attached to an edge portion of the plate type heat spreader to prevent
20 alignment error when the printed circuit boards are attached to the plate type heat spreader.

27. The printed circuit board assembly according to claim 16, further comprising alignment targets attached to
25 predetermined positions of the optical devices and the optical

signal transmitting/receiving printed circuit board to accurately arrange the optical devices.

28. The printed circuit board assembly according to claim
5 16, wherein the plate type heat spreader includes a plurality of signal holes and ground holes formed therein.

29. The printed circuit board assembly according to claim
28, wherein the plurality of signal holes are formed by
10 previously forming larger holes, filling the larger holes with dielectric materials for insulation, forming conductive holes through center portions of the dielectric materials, and gilding the conductive holes, before the plate type heat spreader is attached to the printed circuit boards.

15

30. The printed circuit board assembly according to claim
28, wherein the plurality of ground holes are formed by
previously forming larger holes, filling the larger holes with
conductive paste, forming conductive holes through center
20 portions of the conductive paste, and gilding the conductive holes, before the plate type heat spreader is attached to the printed circuit boards.

31. The printed circuit board assembly according to claim
25 16, wherein the flip-chip bonding of the optical devices is

performed in a positive (+) manner in which electrodes of each optical device are arranged on a light emitting side of the optical device, or a negative (-) manner in which the electrodes of each optical device are arranged on a side of
5 the optical device opposite to the light emitting side thereof.

32. The printed circuit board assembly according to claim 31, wherein the positive (+) flip-chip bonding manner is
10 implemented such that a cavity is formed in a pad on which each optical device is mounted, a material with a high light transmissibility is caused to fill the cavity, and the filling material is polished so as to allow the electrodes of each optical device to be arranged on the light emitting side of
15 the optical device, thus obtaining straightness of light rays.

33. The printed circuit board assembly according to claim 31, wherein the negative (-) flip-chip bonding manner is implemented such that each optical device and its electrodes
20 are formed to be collinear with each other and be epitaxially grown so as to allow the electrodes of each optical device to be arranged on a side of the optical device opposite to the light emitting side of the optical device, thus enabling the optical devices to be surface mounted onto electrode pads to
25 allow the light emitting side to be opposite to a side on

which the electrode pads are arranged.